July 18, 1967 J. W. JACOBS ETAL 3,331,141

APPARATUS FOR INTERMITTENTLY ROTATABLY TUMBLING CLOTHES

Filed Sept. 8, 1964 2 Sheets-Sheet 1

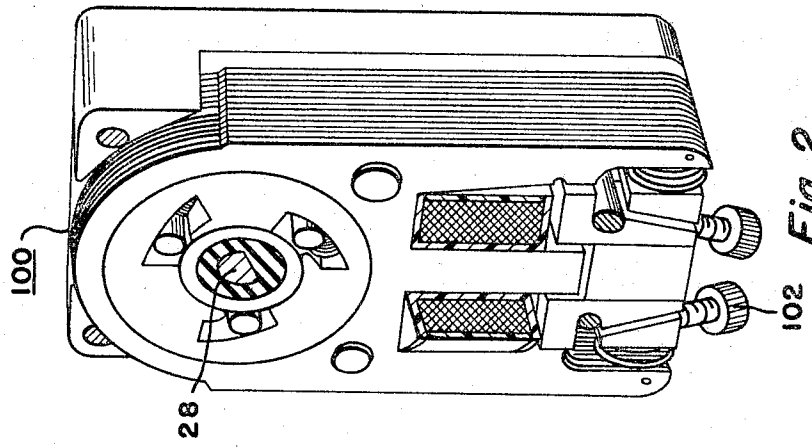

Fig. 2

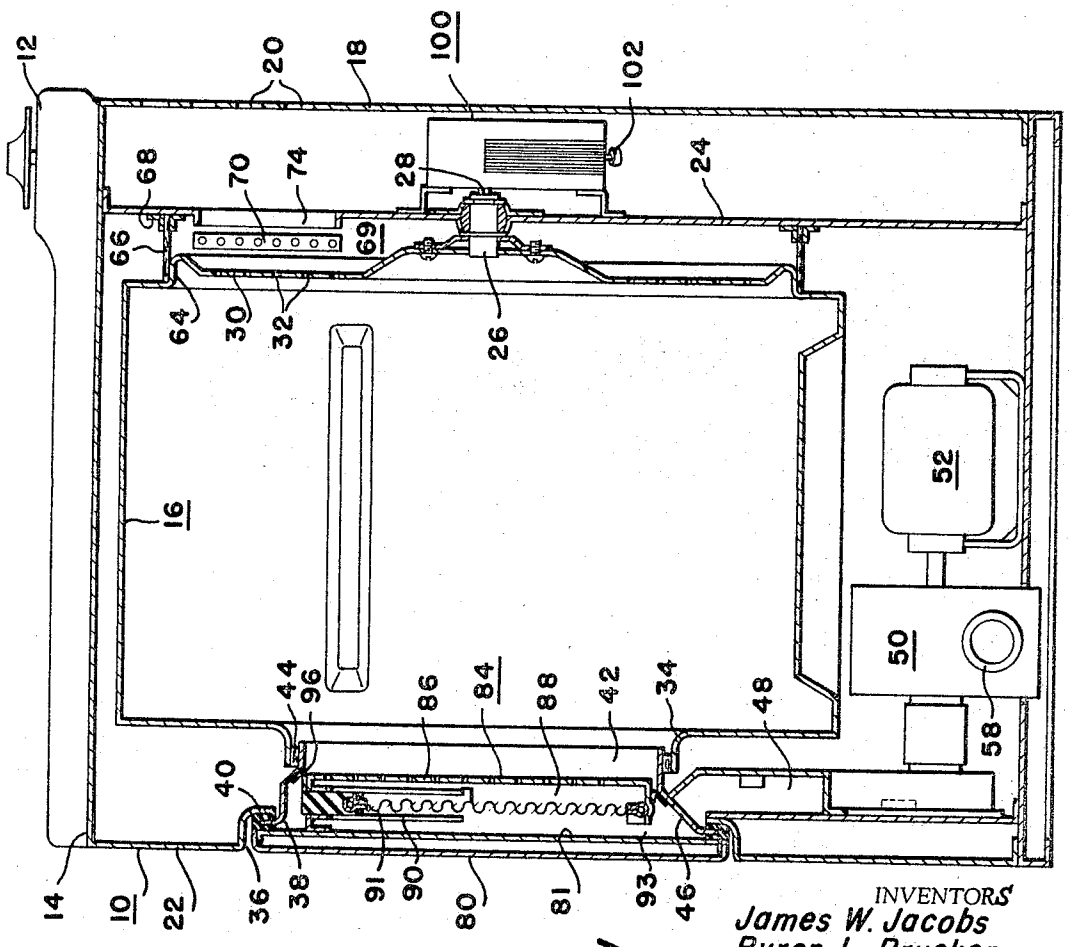

Fig. 1

INVENTORS
James W. Jacobs
BY Byron L. Brucken
Frederick M. Ritchie
Their Attorney

July 18, 1967 J. W. JACOBS ETAL 3,331,141

APPARATUS FOR INTERMITTENTLY ROTATABLY TUMBLING CLOTHES

Filed Sept. 8, 1964 2 Sheets-Sheet 2

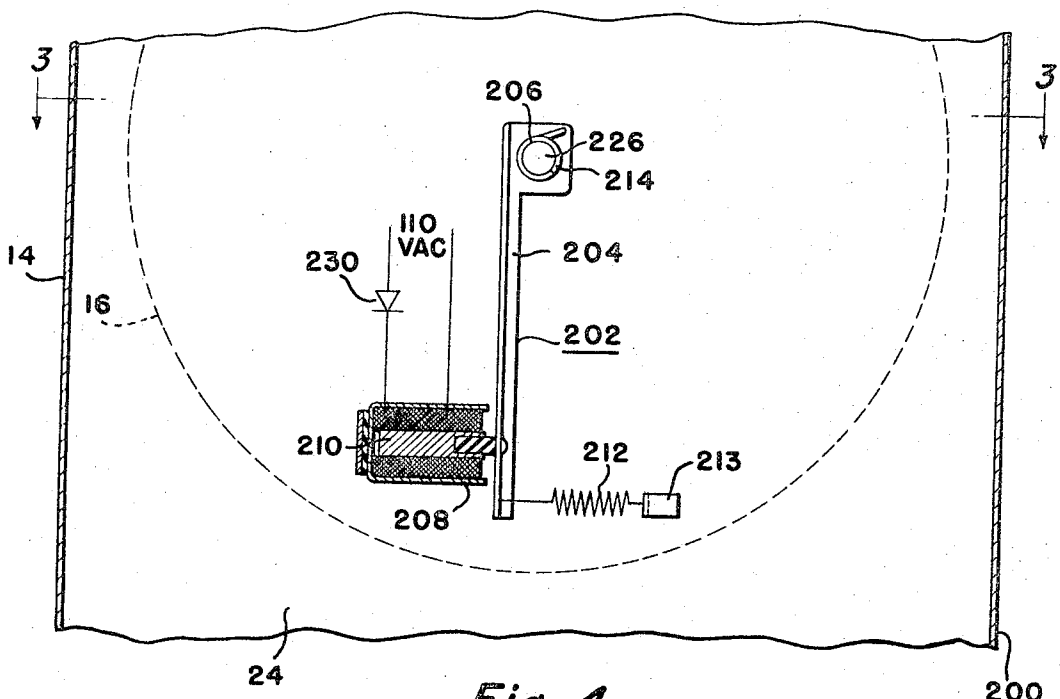

Fig. 4

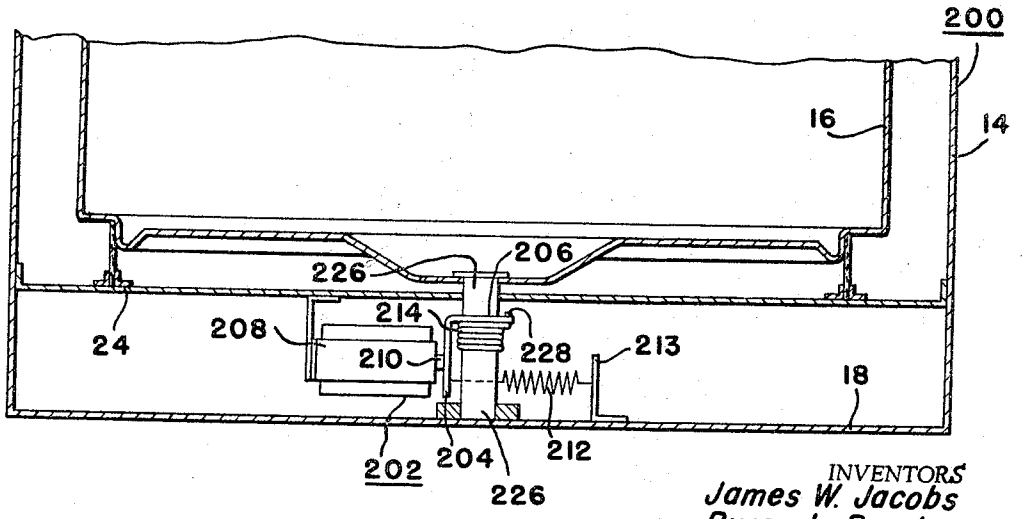

Fig. 3

INVENTORS
James W. Jacobs
Byron L. Brucken
BY Frederick M. Ritchie
Their Attorney

United States Patent Office 3,331,141 Patented July 18, 1967

3,331,141

APPARATUS FOR INTERMITTENTLY, ROTATABLY TUMBLING CLOTHES

James W. Jacobs and Byron L. Brucken, Dayton, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Sept. 8, 1964, Ser. No. 394,691
1 Claim. (Cl. 34—133)

This invention relates to a clothes dryer and more particularly to an improved apparatus and method for tumbling clothes.

In a clothes dryer the idea of tumbling the clothes in a stream of heated air is to expose all of the areas of the fabric to the circulating air. In the case of heavy materials, however, such as shag rugs, the moisture is entrained deep within the pile of the material and is not easily released to the circulating air.

Accordingly, an object of this invention is to provide an improved method and apparatus for intermittently rotatingly tumbling clothes in a clothes dryer.

A more particular object of this invention is the provision of a prime moving system for a tumbling drum which vibratorily rotates the tumbling drum, thereby to agitate the items being dried as they are being tumbled.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a side sectional view of a clothes dryer provided with one embodiment of this invention;

FIGURE 2 is a perspective view of a vibrator type motor suitable for use with the clothes dryer to provide vibratory rotation of the tumbling drum in accordance with one embodiment of this invention;

FIGURE 3 is a fragmentary side sectional view of another embodiment of this invention; and

FIGURE 4 is a sectional view partly in elevation of a vibratory driving means for the embodiment of FIGURE 3.

In accordance with this invention and with reference to FIGURES 1 and 2, a vented type clothes dryer is shown generally at **10**. The dryer **10** includes a control portion **12** having suitable controls for temperature and cycle termination and a cabinet **14** which encloses a rotatably mounted clothes or fabric tumbling drum **16**. The casing **14** is comprised of a rear wall **18** having air inlet openings **20** and a front wall **22**. For supporting the tumbling drum **16**, a rear bulkhead **24** extends from bottom to top in spaced parallel relationship to the rear wall **18**. A drum support shaft **26** is journaled on the bulkhead **24** and includes a driving portion **28** extending into the space between the bulkhead **24** and the casing rear wall **18**. The tumbling drum **16** is formed in a cylindrical shape and includes a rear wall **30** ported or perforated, as at **32**, for facilitating ingress of drying air to the tumbling drum. At the opposite end of the drum an axially directed collar **34** defines the air outlet or access opening for the tumbling drum. The opening formed by the collar **34** axially aligns with an opening **36** in the casing front wall **22**. Interposed between the drum collar **34** and the casing opening **36** is a front port plate or drum front support member **38**. This port plate **38** is fastened in a resilient seal **40** to the casing front wall **22** and has an inwardly extending collar **42** which nests in support relationship within the drum collar **34**. Suitable felt sealing material **44** is interposed between the port plate collar **42** and the drum access collar **34** to minimize leakage at this point from the tumbling drum. The port plate **38** is provided with a plurality of exhaust outlets **46** which

open into a front duct or air passage **48** leading to a blower **50**.

Air circulation through the dryer is initiated by the blower **50**. This blower is driven by a motor **52** to initiate air flow through the tumbling drum. The blower **50** includes an outlet duct **58** which may be connected to the side or rear walls of the dryer for connection therefrom with the atmosphere in accordance with conventional practice.

In the rear wall **30** of the tumbling drum, an annular shoulder **64** is formed to support an annular flexible, noncombustible seal **66** attached thereto by a plurality of L-shaped brackets **68**. The seal **66** engages the inside of the bulkhead wall **24** to define a heater chamber **69** between the bulkhead and the rear wall of the tumbling drum. It is in the annular chamber **69** that a clothes drying heater **70** is disposed.

It is desirable to filter lint from the circulating air as it leaves the tumbling drum. For this purpose an access door **80** is hingedly mounted to the front wall **22** of the clothes dryer and is adapted to close the access opening **36** in the dryer casing and support a lint collecting housing shown generally at **84**. The housing **84** includes a perforated wall **86** in axial alignment with the port plate collar **42** and the drum inlet collar **34**, when the door is closed. The side of the lint collecting housing is formed by a cylindrical wall **88** fastened at one end thereof to an inner panel **81** of the door and at the other end thereof to the perforated wall **86**. At the top of the housing wall **88** a top opening **90** is formed for receiving a lint collector **91**. The collector includes a filter means such as a nylon screen and is slidably removable from the lint collecting housing **84** through the top opening **90**. Along the bottom of the cylindrical wall **88** a cutout **93** is provided to facilitate egress of filtered air from the housing into the front duct **48** by way of the port plate openings **46**. To facilitate an airtight relationship between the lint collecting housing **84** and the port plate **38**, an annular seal **96** is fastened about the periphery of the perforated wall **86**. Thus, when the door **80** is closed, all air leaving the tumbling drum is channeled through the lint collecting housing **84**.

In one embodiment of this invention the tumbling drum **16** is rotated in intermittent pulses by a vibratory motor **100**. The motor **100** can drive the drum at the equivalent desired speed, such as 50 r.p.m., but the drum actually starts and stops many times as it rotates about its bearings. Such intermittent rotation provides vibratory action to the drum and clothes which produces a fabric agitation greatly improving the drying ability of the dryer. In other words, as the drum is being rotated at one frequency, a vibratory motion of much greater frequency is also imparted to the drum. The motor **100** may be provided with adjustment means **102** to vary the vibratory rate of drum advance thereby controlling the amount of agitation to which the fabric is subjected. One suitable motor **100** is sold by the Energy Conversions Systems Corporation of Grafton, Wis., under the trade name Enercon. Enercon inherently is capable of extremely accurate repeatability of predetermined motion without the use of clutch and brake releases required by other motors. This motor will index accurately to one-tenth of a degree and can run forward or backward.

The air flow system defined by the construction outlined hereinabove for a vented clothes dryer is as follows. With the energization of the motors **52** and **100**, both the blower **50** and the tumbling drum **16** are actuated. Air is drawn through the openings **20** into the casing rear wall and enters the heater chamber **69** by way of the inlet opening **74**. After being heated by the heater **70**, the air then enters the tumbling drum through the perforations **32** in the drum rear wall.

Moisture and lint are entrained in the air from the tumbling moist clothes within the tumbling drum and this moist and lint laden air is withdrawn from the tumbling drum by way of the lint collecting housing **84**. Air enters the housing through the perforated housing wall and filters through the lint collecting screen **91**. Filtered air leaves the lint collecting housing by way of the cutout **93**, entering the front duct **48** by way of the port plate openings **46** and is withdrawn by the blower **50** for subsequent disposal by way of outlet **58** to the atmosphere. The vibratory motion imparted to the drum **16** at the same time it is being rotated serves to agitate the fabrics being dried. This agitation aids the tumbling action of the fabrics to facilitate faster evaporation of the moisture and therefore shorter drying times.

Turning now to FIGURES 3 and 4, the second clothes dryer embodiment of this invention is illustrated—the dryer **200** using the same reference numerals to designate counterpart components for those in the dryer of FIGURE 1. The drum shaft **226** of this dryer is adapted to be pulsatingly rotated by a prime moving system shown generally at **202**. More particularly, the pulsating or incremental prime mover **202** includes a drive arm **204** having a hole **206** which fits over the drum shaft at one end thereof and another end extending radially from the shaft toward the periphery of the drum. The drive arm **204** is connected at its outer end on one side thereof to the armature **210** of a solenoid **208** on the bulkhead **24**. On the other side thereof the arm **204** is connected to a return spring **212** fixedly positioned at one end thereof by a bracket **213** on the back wall **18** of the dryer. Thus, the solenoid **208** serves to rock the arm **204** in one direction while the spring **212** returns the arm in the opposite direction. In order to translate this pendulum-like rocking motion into tumbling drum rotation, a one-way spring clutch **214** is selectively grippingly positioned about the shaft **226** with an end tab **228** fastened for actuation in the drive arm **204**. In order for the fabric to be agitated while it is being tumbled, the pulsingly indexing of the drum shaft should be rapid. A power source to rapidly pulsatingly energize the solenoid **208** may include a rectifying diode **230** to provide half-wave pulsing power to the solenoid. The stroke and magnetic pull of the solenoid will be such as to strike a balance with the return spring so that complete pull-in will not occur and the drive arm **204** will resonate.

It should now be seen that an improved method and apparatus has been provided for drying clothes or the like. In addition to tumbling the clothes in a drying medium, the clothes are also subjected to an agitation through the tumbling means which, by its pulsating, somewhat staccato-like rotation, tends to shake the moisture from the fabric while the fabric is being tumbled.

While the embodiments of the present invention as clearly shown constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

A clothes dryer comprising casing means defining a drying chamber for containing clothes during a clothes drying cycle, means for rotatably supporting said casing means, means operable for circulating heated air through said drying chamber for evaporating moisture from said clothes, and drive means operable substantially coextensively with said circulating means for rotating said casing means at a constant speed sufficient to cause said clothes to tumble through said heated air and for imparting a pulsating, staccato-like motion to said casing means during said constant speed to vibrate said clothes simultaneously and coextensively with the tumbling thereof throughout said clothes drying cycle, said drive means including crank arm means having one end unidirectionally, clutchingly connected to said casing means, electromagnetic means connected to said means for supporting said casing means and having an armature connected to the other end of said crank arm means and operable to move said other end in one direction whereby to rotate said casing means through a predetermined arc, yieldable means connected to said crank arm means to move said other end in the reverse direction, and a power supply means for intermittently operating said electromagnetic means, said power supply means including a rectifying diode to provide half-wave pulsing power to said electromagnetic means, and said armature of said electromagnetic means having a stroke and magnetic pull to strike a balance with said yieldable means thereby to cause said crank arm means to resonate.

References Cited

UNITED STATES PATENTS

2,230,345	2/1941	Bradbury	68—24
2,310,107	2/1943	Miller	310—21
2,387,216	10/1945	Hood	68—24
2,448,812	9/1948	Lemire	310—21
2,814,886	12/1957	Fowler	34—45
2,819,540	1/1958	Toma et al.	34—45
3,050,869	8/1962	Bochan	34—164

MARTIN P. SCHWADRON, *Primary Examiner.*

FREDERICK L. MATTESON, JR., *Examiner.*

B. L. ADAMS, *Assistant Examiner.*